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CHILTON'S
AUTOMOTIVE INDUSTRIES
SINCE 1895

FEBRUARY 1987

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February 1987

MAN OF THE YEAR 1987

Father of the Taurus: Lewis Veraldi

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FEBRUARY 1987 VOLUME 167, No.2

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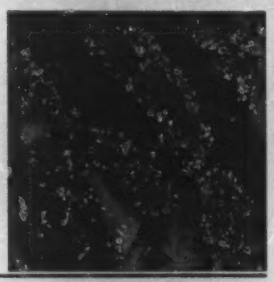

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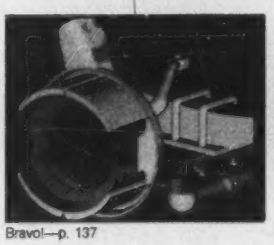

Bravo!—p. 137

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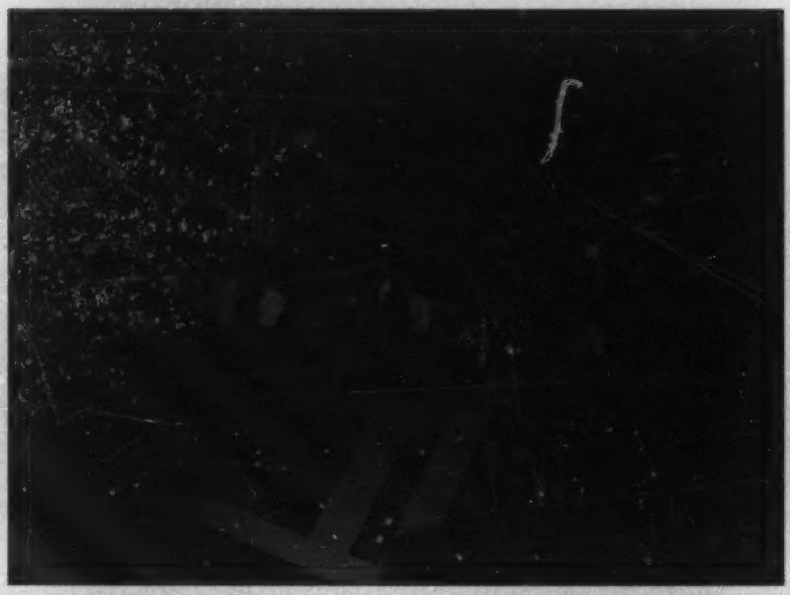
SAGAS OF SUCCESS: MAKING JUST-IN-TIME WORK

For those in the US auto industry who use it as a manufacturing system, just-in-time is paying big dividends.

by Bryan Berry

US automakers finally are waking up to the enormous potential of just-in-time (JIT) manufacturing. Not just a way of reducing inventory, JIT manufacturing is radically altering the automakers' production quality, scheduling, batch size, transportation, communications, and containers. At its best, JIT is linking automakers' and suppliers' plants as though they were one.

US automakers have a long way to go before they match the efficiencies of JIT manufacturing in Japan. Toyota's cost of automotive inventory per vehicle averaged $46 from 1980 to 1985 (*see table*). GM's was $581—a whopping $535 higher!



Seat supplier Hoover Universal prints bar-coded labels for its seats, which it ships JIT. Hoover's assembly plants turn over inventory 40 times a year.

Progress So Far

Still, GM cut total inventory by $5 billion from 1981 to late 1986, according to Leonard J. Ricard, GM's director of production control. The No. 1 automaker had $10 billion in inventory in 1981. General Motors' production has increased by 35% since 1981, so its inventory then would have totaled $14.5 billion at today's volume. Now the company has $9.5 billion in inventory, including about $5.4 billion in material, work-in-process, and supplies.

Turnover at GM's assembly plants has increased from 18 turns a year in 1981 to about 31 today. GM assembly plants in Michigan, where the supply base is centered, have raised inventory turns from 20 to 55 over the same time. A turnover occurs each time all the products in the plant are used, shipped out the door, and replaced by a new set of products.

Leading the pack are the plants at Buick City (Flint), Pontiac (Fiero), and Willow Run, all of which turn over inventory 70 times a year or more. Buick City is aiming at 100 annual turns.

Ford and Chrysler are making similar progress. Chrysler's assembly plants receive $25 million, or 50%, of its parts just-in-time. "We can increase that to 80% in this decade," predicts Richard E. Dauch, Chrysler's executive VP of manufacturing.

Chrysler's Sterling Heights, MI plant averages 70 turns a year. Daily JIT shipments there total $5 million in value; to Windsor, Ont., $5.5 million; and will reach $6 million at Dodge City (Warren, MI) this year.

These plants use in-line sequencing, which means the vehicles stay in the same order on the line throughout the entire assembly process. They're never taken off the line; even repairs and rework are done on-line. For the system to work, Chrysler must receive good parts on time.

"For our assembly plants to use 100% in-line sequencing, 70-80% of the parts must be delivered just-in-time daily," says Dauch.

Now Detroit's big challenge is to use JIT manufacturing not just at the assembly plants but at the fabricating plants as well. Annual turns at both fabricating and assembly plants average 11 at GM and Ford and 14 at Chrysler. That's much lower than the nearly 100 turns at Japanese automakers, including 135 turns at Toyota's assembly plants.

Detroit's drive toward JIT manu-

facturing already has achieved some remarkable efficiencies and erased some woeful inefficiencies. Automakers building seats used to store some 20 days' worth of foam in their assembly plants. Now the supply chain stockpiles 1 1/4 days' worth at most.

In one stunning improvement, a plant at GM's Inland Div. slashed production time for brake hoses from three months to three minutes. The plant used to allow lengthy delays and stockpiles between the departments that cut the hose to length, assemble the fittings, and pressure-test the finished hoses. Now those operations are done in sequence without delay. They're done right next to one another, with no stockpile of parts between the processes.

Getting In Synch

The ultimate in JIT manufacturing is when the supplier makes and ships the parts in the same sequence as the assembler installs them. That's happening today at plants supplying seats, strut assemblies, door trim, carpeting, instrument clusters, and wiring harnesses. For example:

- GM's Delco Div. plant at Livonia, MI make 120 types of struts in sequence for B-O-C Willow Run.
- J.P. Stevens' Michigan plant ships carpeting in sequence to the GM plants at Buick City and Detroit/Hamtramck.
- Oakley Co. mounts, balances, and inflates tire-and-wheel subassemblies in sequence for the Fiero plant.
- GM's AC Spark Plug Div. ships 300 varieties of instrument clusters to Buick City in sequence.
- GM's Detroit/Hamtramck plant receives 1700 parts numbers in sequence, including seats (from Windsor Trim), carpets, front suspensions, seat belts, and door trim. In all, the plant get 90% of its parts (by dollar value) just-in-time.

JIT manufacturing has swept the seat-making industry. Lear-Siegler, Windsor Trim, Douglas & Lomason, Findlay Industries, and Hoover Universal all ship just-in-time, often in sequence, to domestic plants.

Intake manifolds from CMI-Southfield are shipped in plastic pallets molded to the shape of the part to increase J-I-T efficiency.

Hoover Universal has eight plants dedicated to making and delivering seats in sequence to assembly plants not more than 50 mi (*80 km*) away. These include NUMMI; Nissan at Smyrna, TN; GM at Baltimore, Pontiac, Fort Wayne, and Shreveport, LA; and Chrysler at Sterling Heights. Hoover presently is building three more plants dedicated to the Saturn Corp. at Spring Hill, TN; American Motors at Brampton, Ont.; and Chrysler at Belvidere, IL.

Hoover's JIT assembly plants turn over inventory 40 times a year; its component plants, about 18. "The most inventory we keep at a plant is a day's worth. We don't like to do that," said R. Eugene Goodson, group VP and general manager of Johnson Controls' automotive systems group (Hoover's new name).

Automakers greatly aid JIT manufacturing when they fix production schedules as far in advance as possible. They used to stabilize schedules only two or three days in advance. Now some plants are fixing schedules five and even ten days before production. Last year Chrysler began generating fixed ten-day "supplier delivery schedules" (SDS) at its assembly plants in Sterling Heights, Dodge City, Windsor, and Belvidere.

"All our assembly plants will use 10-day SDS by the end of the 1987 model year," said Andrew R. Pollack, director of Chrysler's production programming and scheduling. "Ten days exceeds the production cycle times of most of our suppliers. With 10-day SDS, there's no supplier anywhere in the US who shouldn't be able to supply us just-in-time."

Enter Heijunka

Coordinating JIT manufacturing is toughest when the supplier and automaker are thousands of miles apart. But NUMMI is receiving parts at its

Japanese Inventory Costs: Still Lower Than US

	Cost of inventory per vehicle					Material, work-in-process, and supplies in 1985 (millions)	Worldwide Sales in 1985 (thousands of units)
	1981	1982	1983	1984	1985		
GM:	628	568	519	612	577	$5368	9305
Ford:	528	493	459	406	442	$2491	5634
Chrysler:	663	551	593	526	430	$927	2157
Toyota:	43	44	49	53	42	$154	3694
Nissan:	95	81	82	84	117	$307	2634

Source: Annual Reports

Note: All figures are computed by the last-in, first-out (LIFO) method, except Chrysler's figures for 1981, '82 and '83, which were computed by the first-in, first-out (FIFO) method; and all of Toyota's inventories of work-in-progress and supplies and Nissan's work-in-process, which were computed by the average cost method.

California site just-in-time even though most of its suppliers are in Japan or the American Midwest.

NUMMI places orders with its Japanese suppliers by satellite daily. Parts are consolidated at Kamigo Center in Japan. Three ships carrying parts for NUMMI arrive at the docks at Oakland, CA, every week.

Trucks owned by Leaseway Corp. pick up parts for NUMMI from 17 suppliers in the Midwest and consolidate them in Detroit and Chicago. The parts in Detroit are trucked to Chicago. Every day ten railroad car loads of parts, including such bulky items as bumpers from GM Guide, go from Chicago to the NUMMI plant at Fremont, CA.

NUMMI's suppliers don't deliver large shipments of the same-type parts. Instead, they maintain a balanced mix of different types of parts.

This is heijunka, which NUMMI manufacturing VP Kosuke Ikebuchi defines as "the overall averaging in the production schedule of the variety and volume of items produced in a given time period."

US automakers are using daily "milk runs" of trucks that carry parts from two or more suppliers from distant points in the nation. Chrysler receives 41 milk runs daily.

The longest is from El Paso, TX. There the truck picks up seat belts from American Safety Co. and wiring from both a Chrysler division and United Technologies' Essex Div. The truck stops in Fort Worth to pick up cruise control components from Specific Cruise Co.

After a 56-hour journey, the truck unloads these parts at Chrysler's Detroit-area plants. The assembly plants carry only a 6-8 hour inventory of these parts, so they're used the very same day they arrive from Texas.

GM and Ford also are expanding their dedicated transportation networks. All GM assembly plants will receive milk runs by early this year.

These dedicated trucking runs have enabled GM to close a large warehouse in the Detroit suburb of Westland, MI. For the past 15 years, trucks delivered about 8000 different low-value parts such as nuts, bolts, and brackets to the warehouse. From Westland railroad cars carried these items to GM assembly plants in Van Nuys, CA; Shreveport, LA; Baltimore; Doraville, GA, and elsewhere across the nation. Now the trucks, not the warehouse, consolidate these different parts and deliver them to GM's far-flung plants.

The Goal: Zero Inventory

JIT manufacturing is causing changes in the containers used to transport parts. Automakers are beginning to use plastic pallets molded to the shape of the parts, so the parts don't slide around. Once delivered, the empty pallets can then be nested inside one another for more efficient return shipment.

In one ingenious application of JIT, CMI-Southfield (MI) ships three truckloads of pallets loaded with intake manifolds every night to C-P-C's engine plant at Tonawanda, NY. Since only one truck is needed to bring the empty nested pallets back to Southfield, the company sends the other two trucks to Wabash, IN. There they pick up aluminum castings from CMI's foundry and transport them to the Southfield machining plant.

General Motors is requiring all its suppliers to be linked electronically with its plants; most are. GM asks its suppliers to use the electronic specs developed by the Automotive Industry Action Group (AIAG).

C-P-C also requires suppliers to affix bar-coded labels to containers. However, it may allow small suppliers to use pre-printed labels.

"We have brought our whole supplier community into our assembly process," said Chrysler's Pollack. "Our ultimate goal is to have all parts manufactured and delivered as if they were an integral part of the assembly operation. Our goal is zero inventory." AI

Bryan Berry is Detroit Editor for Chilton's Iron Age magazine.

WATCH OUT, KOREA: HERE COME THE BRAZILIANS!

After years of promising potential, Brazil may be about to reach the critical mass it needs to become an automotive force majeur.

by Paul Eisenstein

Brazil's explosion onto the global automotive battlefield has been suffering from fizzling fuses for years. Now it finally looks as though the big bang is going to take place. It's been a long time coming.

It's an embarrassment for a country with Brazil's low-cost potential and well-developed auto industry to have been beaten to the US market by upstarts such as Korea, Taiwan and Yugoslavia.

The much-touted comparisons of Brazil to Korea are particularly ironic when you delve below the chest-thumping. Korea had no domestic auto industry or market to speak of five years ago, and the car industry it has now resulted from massive transfers of Japanese and German technology. Far from being the self-creation of a modern industrial destiny, Korea's auto industry spontaneously erupted from a pile of joint-ventures and equity papers.

Brazil, on the other hand, has a strong home market, and it's on this strength that the country lays claim to being the world's tenth-largest motor vehicle producer. It has been exporting vehicles to Africa and Europe for several years now, and it's rapidly approaching the first hurdle—the race to enter the tough and highly lucrative American market.

Ford do Brasil assembly line at Sao Bernardo. Cars are the popular Del Rey.

All The Way—To the USA

Volkswagen United States, of course, just began importing the Fox, a $5700 subcompact with which it hopes to recapture a share of the low-end market segment it effectively abandoned in the 1970s when it dropped the Beetle (see *Jan. '87 AI, p.52*). But the Beetle was imported from West Germany; the Fox is being built in Brazil.

"Brazil is the next major auto producing country," insists Stephen Scharf, who recently retired from the Chrysler Corp. where he was in charge of developing an international import and manufacturing strategy. "That country provides a tremendous opportunity, and any company that avoids Brazil is stupid," he says emphatically. Like the developing Southeast Asian carmakers, Brazil's auto labor rates are extremely low—barely 10% of US union wages. But unlike the South Koreans and Taiwanese, Brazil has a well-developed automotive infrastructure, producing in the neighborhood of 99% of the components used in its assembly lines. The Latin nation also has the advantage of a tremendous supply of raw materials.

Not only do the carmakers operate their own component plants, but so do some of the best-known American and European auto suppliers, including Bendix, Cummins, Eaton and Rockwell. That is the result of highly restrictive government domestic content legislation, which has also encouraged carmakers in that country to export whenever possible. While Volkswagen is the first to bring fully-assembled cars to the US, Brazil has been supplying the American auto industry with components for quite a few years.

The Trek Up North

Ford's Brazilian operations, of course, ship the Cargo-series truck,

Brazil's automotive infrastructure is already in place. Shown is Ford's Tatui proving ground.

Volkswagen's new US-market Fox: A Brazilian litmus test?

Brazil Pass. Car Sales

(Through Sept. '86)

1974	691,000
1979	864,000 (All-time Peak)
1980	619,000
1981	459,000
1982	570,000
1983	621,000
1984	547,000
1985	614,000
1986	544,000 (Up 27%)

an in-line diesel for large trucks, car radios, and the 2.3-L ohc engines for the Ford Thunderbird, Merkur and Ranger.

General Motors imports the 2.0-L ohc four used in several J-car models. According to GM spokesman George Schreck, "We average at least 15,000 units every month."

VW do Brasil also shipped engines to the US in 1981 for the Rabbit; however, those operations were later shifted to Mexico. One of VW's Brazilian plants, commercial vehicle operation, will begin exporting some heavy trucks to Paccar this year for sale under Paccar labels (Paccar manufactures Kenworth and Peterbilt).

Meanwhile, Brazil's 1500 automotive component manufacturers, many owned by American manufacturers, are also making inroads into the United States. Their exports more than doubled between 1982 and 1985, though they still account for a modest 4% of all imported US auto parts. Officially, shipments were expected to total around $600 million in 1986, though that figure is believed to be artificially low because importers of Brazilian parts usually buy from their own subsidiaries there.

All signs indicate Brazilian export volume to the US will be increasing in the near future. Chrysler Motors chairman Gerald Greenwald says, "We're looking very seriously at Brazil. We recently signed an agreement with the government for a major export program out of Brazil. We're developing an increasing number of long-term relationships with suppliers in Brazil."

Greenwald says these focus "on components, not vehicles;" however, there is evidence that Chrysler, which has been discussing various business relationships with Italian carmaker Fiat SpA, may be interested in importing the Uno, a mini-compact built at Fiat's Brazilian factories.

Clearly, any such program would win the blessing of the Brazilian government, Greenwald says: "They owe $100 million—they're one of the world's great debtor nations. They've got to export to pay the debt."

Brazil Car Market Share

(Through Sept. '86)

Year	VW	GM	Ford	Fiat
1974	57%	19%	19%	0%
1979	54.5	18	15	12
1980	51	21	15	13
1981	47	24	19	10
1982	46	26	17	10
1983	42	27	19	11
1984	43	27	20	10
1985	40	27	20	13
1986	43	26	19	13

Capacity Aplenty!

And Brazil has the industrial base to meet growing demand. Because of the economic, social and political uncertainty in the Latin American nation's recent past, its domestic car sales have fluctuated wildly: from a high of 864,000 passenger cars in 1979, to a low of 459,000 two years later. Sales have been rising in recent years, and reached 544,000 during the first nine months of 1986.

But that still leaves sizable unused capacity in both component and assembly plants. GM's 1985 Brazilian car and truck sales totaled 191,000. Capacity at its two assembly lines is currently 261,000. The automaker had planned a five-year expansion program, though that has been cut back for a variety of reasons, including General Motors' financial prob-

Alcohol fuel experience may be Brazil's ace-in-the-hole.

VW do Brasil builds the chassis/cab of PACCAR's new Class 7 MidRanger; it utilizes powertrain, axles, brakes, tires from US suppliers.

lems in the US.

Even without adding extra capacity, GM is the second largest automaker in Brazil, with 26% of the passenger car market in 1985. The largest is VW, with 43%. Ford held a 19% share, and Fiat 13%. Ford is the largest truck manufacturer, with a 1985 market share of 28%. Number two is Volkswagen, with 20% and GM and Mercedes are tied with 18%. The rest is divided up among several manufacturers, including Fiat, Saab-Scania and Toyota.

It is interesting to note that while Toyota does supply a small number of trucks, the Brazilian vehicle market is essentially owned by European and American manufacturers, in stark contrast to the situation in Southeast Asia.

"The local content requirements are so high as to be virtually intolerable to the Japanese," auto analyst Maryann Keller says.

Does all this mean the Brazilians can count on making steady inroads into the United States? Not at all.

AutoLatina

There clearly remains much concern about the potential for social and political instability in the country, as well as concern about negative economic developments.

For years, Brazil was wracked by inflation measuring hundreds of percent annually. More recently, a currency change and wage-and-price controls have brought this runaway spiral under control, but these moves have also hurt many Brazilian manufacturers, who say they have not been able to recoup in higher prices the cost of recent wage hikes authorized by the government.

VW, for example, posted a $38.5 million loss on its Volkswagen do Brasil subsidiary in 1985. Ford also lost money on its Brazilian subsidiary, prompting the two carmakers to launch a joint-venture uniting their Brazilian and Argentine facilities as part of the new AutoLatina. Volkswagen will become the dominant partner in the arrangement, with a 51% holding.

"The main objectives of the venture would be to ensure continual updating of technology, higher operating efficiencies and better use of manufacturing facilities," notes Ford president Red Poling.

Together, VW and Ford have 15 industrial plants in the two countries, with the capacity to produce 900,000 cars and trucks a year. They employ 75,000 people, and through their 1500 dealers, last year's sales totaled $4 billion.

Brazil's Secret Weapon

It is unclear at this point exactly how AutoLatina will ultimately affect the international plans the two carmakers have been developing for their Brazilian component and assembly lines.

That is likely to depend on a variety of external factors. For beyond financial considerations, there is also one of image. The South Koreans have been able to catch a ride on the coattails of the Japanese, with their reputation for quality and value.

But all the Koreans have contributed to the world automotive industry so far are low wages and a certain business aggressiveness. Japan, once an up-and-coming newcomer itself, contributed that and a whole new concept of manufacturing technology which enabled it to gain an advantage no other country has yet matched. If all Korea has to offer is decent quality and low costs, then it's going to have to keep a worried eye looking over its shoulder as other competitors jump into the market.

Therein may lie Brazil's ultimate advantage. Sure, Brazil has a well-developed auto industry, low wages and a big home market. But it has more than that.

It is the only country in the world that mandates the use of engines which can run on ethanol. As such, it has the biggest and best technological base for alchohol fuels. And as virtually all energy experts in the industry point to alchohol as the fuel of the future, Brazil may may well have the trump card it needs to nose out other Third World competitors as we look towards the 21st century. AT

AUTOMAKER QUARTERLY REPORT

Final '86 tallies show the affect of transplants on the domestic market, strength at Ford and Chrysler and optimism for AMC in '87.

by Tom O'Grady

While 1986 broke sales records, increased competition from imports held sales of North American-built cars down at the 1985 level of 8.2 million units. Because transplants (foreign vehicles built in the US) increased from 410,000 to 605,000 units, total traditional domestics experienced a declining market in a record year.

It was a year of contrasts. GM, whose losses accounted for almost the entire picture, saw sales decline from 56.2 to 55.2% of the domestic market and dip below 50% during the last two months of 1986. Ford lost one-tenth of a percent, but was extremely strong at year's end. Chrysler was the exception: It gained four-tenths of a percent, for 14.3% of the market.

AMC's tough year ended positively, with Chrysler leasing part of the Kenosha plant. We are still concerned with the company's wide future product mix and its ability to change its image, but reports of significantly improved quality are beginning to surface. New models look very favorable. If the right ingredients are mixed in the right order, AMC might nearly break even in 1987.

For GM, 1987 is expected to be a tougher year than '86. Plant cutbacks and layoffs will produce cost savings, but the continuing decline in sales will have the most effect. The introduction of the new W-cars and some redesigns on E- and K-cars will be anxiously awaited. Ford and Chrysler can also expect a slight decline in earnings, as a result of new product launches rather than from loss of sales.

Honda's plans for 1987 include increased production at Marysville, OH, which will mean greater efficiency and higher sales. We expect Subaru to be successful in reducing costs this year, and to sell its entire allotment of vehicles from Japan. AT

WHAT'S HOT! Domestic Auto Sales (4th Quarter Results)

Carline	'86	'85	% Change
Celebrity	408,946	363,619	12.5%
Escort	402,181	420,690	(4.4%)
Cavalier	357,120	431,031	(17%)
Ciera	329,930	333,585	(1.1%)
Accord*	325,004	268,420	21.8%
Tempo	265,382	281,144	(5.6%)
Taurus	263,450	4056	6395%
Olds 88	261,260	188,129	38.8%
Century	240,747	234,508	2.66%
Honda Civic	235,801	208,031	13.3%

*—Includes imports
( )—Negative value

Domestic Light Truck Quarterly Production

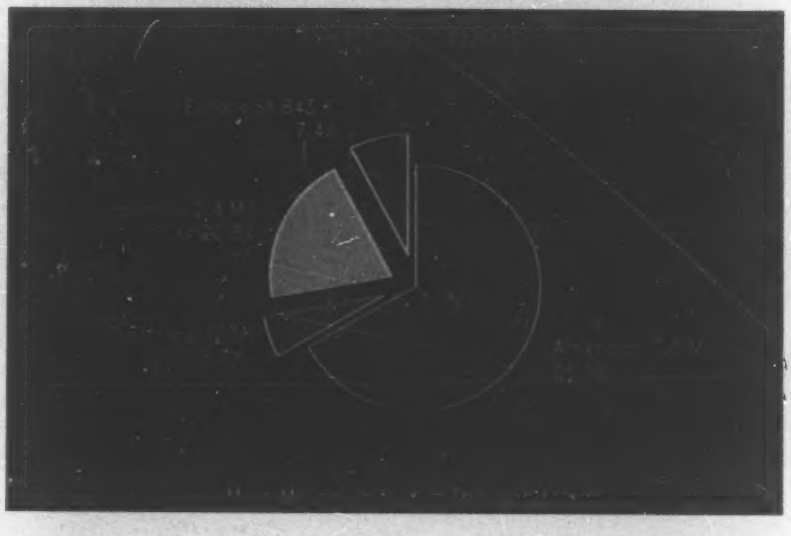
Truckline	2-'86	3-'86	4-'86
Chrysler Vans	29,344	19,651	32,313
Sport Utility	6663	6,441	6830
....Minivagon	77,051	56,811	69,844
Lt Conventional	34,370	48,812	64,215
Ford Aerostar	45,827	41,142	41,153
.....Bronco	15,407	10,322	10,322
.....Econoline	62,902	45,957	58,079
.....Ranger	86,950	73,124	76,441
.....Bronco II	31,862	25,081	30,648
.....Light Conv.	177,432	146,735	98,750
Chevy..Blazer	7834	6352	7255
.....Suburban	17,450	13,582	12,257
.....P-Model	13,141	7608	7846
.....S-10	61,889	66,846	48,650
.....Blazer S	42,389	42,977	33,445
.....Astro	42,127	39,270	38,114
.....Van	43,383	27,386	24,165
Light Conventional	114,224	89,385	76,470
.....Sierra	--	--	1531
GMC..Jimmy	2179	2263	2453
....Suburban	6398	5989	7083
.....P-Model	1508	1135	1861
.....S-15	16,834	16,646	12,759
.....Jimmy S	11,539	12,053	10,287
.....Safari	10,394	9632	9664
.....Van	14,956	8069	8360
Light Conventional	39,658	30,213	26051
.....Sierra	--	--	610
Nissan.Pkup	46,222	23,135	20,228

US Passenger Car Market Shares To Date

Manufacturer	Sales	% Total
General Motors	4,693,161	41.06%
Ford	2,080,822	18.21%
Chrysler	1,308,991	11.45%
Honda/Acura	693,515	6.07%
Toyota	641,087	5.61%
Nissan	546,151	4.78%
VW	204,561	1.79%
Subaru	179,100	1.57%
AMC/Renault	77,005	0.67%

Thomas O'Grady heads Integrated Automotive Resources, Inc. in Wayne, PA. (215) 647-6978.

FINANCIAL SNAPSHOT



Passenger Car Market Share By Geographic Base

Manufacturers	Total Sales	Total Market Share
American	7,609,500	66.58%
Japanese	2,371,676	20.75%
European	843,332	7.38%
US Built Imports (VWoA, Honda, NUMMI, Nissan, Renault)	605,163	5.29%
Total	**11,429,671**	**100.00%**

Stock Earnings